GEOLOGIC LOG OF DRILL HOLE NO. DH-04-1

FEATURE: Black Rock Alternate Damsite
LOCATION: North of Washington State Highway 24
BEGUN: 1/30/04 FINISHED: 3/31/04
DEPTH AND ELEV OF WATER
LEVEL AND DATE MEASURED: 190.9 (1156.45) 3/31/04

PROJECT: Yakima R. Basin Water Storage Feas. Study
COORDINATES: N 439,357.5 E 1,790,476.4
TOTAL DEPTH: 562.3
DEPTH TO BEDROCK: 145.3

STATE: Washington
GROUND ELEVATION: 1347.4
ANGLE FROM HORIZONTAL: AZIMUTH:
HOLE LOGGED BY: Stelma/McAffee/Lyon
REVIEWED BY: R. A. Link

NOTES	DEPTH	% RECOVERY	SPT	ENGINEERING PROPERTIES: WEATHERING	HARDNESS	FRACTURE DENSITY	RQD	FIELD CLASSIFICATION	LAB CLASSIFICATION	GEOLOGIC UNIT	GRAPHIC	HOLE COMPLETION	CLASSIFICATION AND PHYSICAL CONDITION
All elevations measured from ground surface and are same as driller reported. PURPOSE OF HOLE: To determine foundation stratigraphy and rock fracturing characteristics for hydrogeologic testing. DRILL SETUP: Setup on original ground along the alternate Black Rock dam axis approximately 230 feet north of Washington State Highway 24. DRILLING EQUIPMENT: Truck mounted Ingersoll-Rand T-2 Truck mounted drill. DRILLER: Chris Peterson DRILLING METHODS: 0.0-183.0': Advanced hole with PQ wireline core barrel (3.336" I.D.) and diamond bit using polymer (EZ Mud) as circulating fluid. Advanced 6-inch surface casing to 148.0' to stabilize hole and enhance fluid return. Attempted to obtain drive samples (3" I.D.) at 13.2' and 22.0', both met refusal. 183.0-562.3': Advanced hole with HQ wireline core barrel (2.50" I.D.) and diamond bit using polymer (EZ Mud) as circulating fluid. DRILLING CONDITIONS: 0.0-13.2': Fast and smooth. 13.2-31.7': Slow to fast and rough. 31.7-75.0': Fast and smooth. 75.0-90.0': Slow and rough. 90.0-120.0': Fast and smooth. 120.0-145.5': Slow and rough, blocking. 145.5-180.0': Slow, smooth and hard with occasional blocking. 180.0-183.0': Slow and rough with frequent blocking. 183.0-211.4': Slow, smooth and hard. 211.4-255.8': Slow, smooth to rough with occasional blocking. 255.8-276.0': Slow and	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95	8 80 40 0 19 48 8 100 100 67 88 94 0 94 100 100 100 100 100 100 100						SM (GP)c SP-SC SP (GC)sc (SC)g (SC)g Cobbles SC (SM)g		Qe Qh Tr			0.0-7.5': **QUATERNARY LOESS DEPOSITS (Qe).** Surficial deposits of silt with lesser amounts of clay, composed primarily of wind-blown silt with small amounts of fine sand and volcanic ash. Description is based on PQ-size core samples and cuttings returned. 7.5-31.7': **QUATERNARY ALLUVIUM DEPOSITS (Qh).** Undifferentiated medium to coarse-grained sand with fines, gravels, cobbles and boulders composed primarily of basaltic detritus from local sources. Description is based on PQ-size core samples and cuttings returned. 7.5-3`31.7': POORLY GRADED GRAVEL WITH COBBLES (GP)c. About 100% coarse, hard, subrounded gravel; dry, black (basalt) with white coatings (caliche). TOTAL SAMPLE (BY VOLUME): About 40% 3- to 5-inch, hard, subrounded cobbles; remainder minus 3 inch; maximum dimension, 125 mm. 31.7-90.5': **TERTIARY RINGOLD FORMATION (Tr).** Composed of fluviolacustrine sand, silt and clay, with layers of hard, gray to black, angular to subrounded cobbles and gravels in a matrix of fine to coarse sand and fines near the middle and base of the unit. Material is generally well indurated. Descriptions are based on PQ-size core samples. 31.7-38.0': POORLY GRADED SAND WITH CLAY (SP-SC). About 90% fine to medium, hard, subangular sand; about 10% fines with medium plasticity; maximum size, medium sand; dry, tan, homogeneous. 38.0-39.0': POORLY GRADED SAND WITH CLAY (SP-SC). About 90% fine to medium, hard, subrounded to subangular sand; about 10% fines with medium plasticity and medium toughness; maximum size, medium sand; dry to moist, gray to white, homogenous. 39.0-43.0': CLAYEY GRAVEL WITH SAND AND COBBLES (GC)sc. About 60% predominantly fine, hard, subrounded gravel; about 20% fine to coarse, soft to hard, subrounded sand; about 20% fines with medium plasticity and medium toughness; dry to moist, reddish brown, abundant iron oxide, soft weathered medium sand-sized plagioclase and mafic fragments, homogenous, no reaction with HCl. TOTAL SAMPLE (BY VOLUME): About 40% 3- to 5-inch, hard, subrounded cobbles; remainder minus 3 inch; maximum dimension, 100 mm. 43.0-72.0': CLAYEY SAND WITH GRAVEL (SC)g. About 60% fine to coarse, hard, subrounded sand; about 20% fines with medium plasticity and medium toughness; about 20% fine, hard, subrounded gravel; maximum size, 20 mm; moist, reddish brown to brown, abundant iron oxide, scattered tuffaceous clasts (weathered basalt, cinder, pumice fragments), homogenous, no reaction with HCl. 72.0-80.0': CLAYEY SAND WITH GRAVEL AND COBBLES (SC)gc. About 50% fine to coarse, hard, subrounded sand; about 30% fine, hard, subrounded

COMMENTS: Samples were logged in the field using Designation USBR 5005-86, "Procedures for Determining Unified Soil Classification (Visual Method)."

Center column descriptors are defined in the Reclamation Engineering Geology Field Manual, Volume 1, Second Edition, distributed February 1999.

Cs = Casing Sz = Size of Casing I.D. = Inside Diameter O.D. = Outside diameter

Geologic unit descriptions and stratigraphy based partially on consulting discussions with Dr. Bentley and geologic interpretations presented in the following reports:

"Black Rock Reservoir Study, Initial Geotechnical Investigation, Prepared for Benton County Sustainable Development by Washington Infrastructures Services, Inc., Dated January 2003.

"Geologic Investigation Black Rock Dam, Alternate Dam Site, Yakima County, Washington, Prepared for U.S. Bureau of Reclamation by Columbia Geotechnical Associates, Inc., Dated February 12, 2004.

GEOLOGIC LOG OF DRILL HOLE NO. DH-04-1

FEATURE: Black Rock Alternate Damsite
LOCATION: North of Washington State Highway 24
BEGUN: 1/30/04 FINISHED: 3/31/04
DEPTH AND ELEV OF WATER
LEVEL AND DATE MEASURED: 190.9 (1156.45) 3/31/04

PROJECT: Yakima R. Basin Water Storage Feas. Study
COORDINATES: N 439,357.5 E 1,790,476.4
TOTAL DEPTH: 562.3
DEPTH TO BEDROCK: 145.3

STATE: Washington
GROUND ELEVATION: 1347.4
ANGLE FROM HORIZONTAL: AZIMUTH:
HOLE LOGGED BY: Stelma/McAffee/Lyon
REVIEWED BY: R. A. Link

NOTES	DEPTH	% RECOVERY	SPT	ENGINEERING PROPERTIES: WEATHERING	HARDNESS	FRACTURE DENSITY	RQD	FIELD CLASSIFICATION	LAB CLASSIFICATION	GEOLOGIC UNIT	GRAPHIC	HOLE COMPLETION	CLASSIFICATION AND PHYSICAL CONDITION
smooth. 276.0-303.2': Slow and smooth to rough with occasional blocking. 303.2-421.5': Slow, smooth and hard. 421.5-431.5': Slow and smooth to rough with occasional blocking. 431.5-451.5': Slow, smooth and hard. 451.5-471.2': Slow and smooth to rough with occasional blocking. 471.2-494.0': Slow, smooth and moderatley hard. 494.0-500.0': Fast, smooth and moderately rough. 500.0-555.8': Slow and smooth with occasional blocking. 555.8-562.3': Slow, smooth and hard. CASING RECORD: 2004 Cs Depth Depth Date Sz Hole Cs --- 01/30 6" 19.8' N/A 01/31 6" 19.8' 12.5' 02/02 6" 22.4' 22.0' 02/03 6" 31.7' 31.7' 02/04 6" 50.5' 31.7' 02/05 6" 50.5' 51.5' 02/06 6" 80.0' 51.5' 02/07 6" 105.0' 51.5' 02/09 6" 130.7' 51.5' 02/10 6" 132.0' 81.5' 02/11 6" 132.0' 132.0' 02/18 6" 142.5' 132.0' 02/19 6" 152.4' 142.0' 02/20 6" 155.0' 148.0' 02/21 6" 175.0' 148.0' 02/23 6" 183.0' 148.0' 02/24 4" 211.4' 183.0' 02/25 4" 238.2' 183.0' 02/26 4" 252.0' 183.0' 02/27 4" 271.4' 183.0' 02/28 4" 289.7' 183.0' 03/01 4" 310.3' 183.0' 03/02 4" 340.4' 183.0' 03/03 4" 358.2' 183.0' 03/09 4" 385.6' 183.0' 03/10 4" 411.5' 183.0' 03/11 4" 441.5' 183.0' 03/12 4" 469.6' 183.0' 03/13 4" 488.8' 183.0' 03/15 4" 509.6' 183.0' 03/16 4" 539.6' 183.0' 03/17 4" 562.3' 183.0' FLUID COLOR: 0.0-562.3': Drill mud (EZ mud with Diamond Seal). FLUID RETURN: 0.0-12.5': 100% 12.5-22.0': 75% 22.0-27.0': 80% 27.0-31.7': 90% 31.7-75.0': 100% 75.0-80.0': 95% 80.0-105.0': 100% 105.0-120.0': 95% 120.0-125.0': 100% 125.0-130.0': 70% 130.0-142.5': 0% 142.5-152.4': 97% 152.4-155.0': 80%	105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210 215	98 100 100 100 100 96 65 90 18 64 90 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100		W3	H3	FD7 FD8 FD7 FD9 FD6 FD5 FD7	6 0 10 0 21 65 27	Siltstone Peperite (GC)s GP Basalt		Trr Tp			gravel; about 20% fines with medium plasticity and medium toughness; moist, reddish brown, abundant iron oxide, homogenous, no reaction with HCl. TOTAL SAMPLE (BY VOLUME): About 20% 3- to 5-inch, hard, surbrounded cobbles; remainder minus 3 inch; maximum dimension, 100 mm. 80.0-90.5': COBBLES WITH CLAYEY SAND. TOTAL SAMPLE (BY VOLUME): About 70% 3- to 5-inch, hard, surbrounded cobbles; about 20% 6- to 12-inch, hard, surbrounded cobbles; remainder minus 3 inch; maximum dimension, 150 mm. MINUS 3-inch FRACTION (BY VOLUME): About 80% fine to coarse, hard, subrounded sand; about 20% fines with medium plasticity and medium toughness; brown, abundant iron oxide, homogeneous, no reaction with HCl. 90.5-118.5': **TERTIARY RATTLESNAKE RIDGE MEMBER (Trr)** of the Miocene Ellensburg Formation. Unconsolidated gravel, sand and cobbles with silt and clay. Black, gray to mottled, weathered basalt and tuffaceous sediments (?). Descriptions are based on PQ-size core samples. 90.5-95.0': CLAYEY SAND (SC). About 60% fine to medium, hard, subrounded sand; about 40% fines with medium plasticity and medium toughness; maximum size, medium sand; moist, gray to tan, blocky structure, firm to dense, homogenous, no reaction with HCl. 95.0-104.0': SILTY SAND WITH GRAVEL (SM)g. About 70% fine to medium, hard, subrounded to subangular sand; about 20% fines with medium plasticity and medium toughness; about 10% fine, hard, subangular gravel; maximum size, medium sand; moist, gray, scattered white and yellow stringers of weathered plagioclase (pasty texture), traces of caliche, homogenous, firm to dense; weak reaction with HCl. 104.0-118.5': SILTSTONE (TUFFACEOUS). Reworked pumicite. Fine to medium grained, heterogenous, well indurated silt to medium-sand sized lithic fragments, pumice and ash. Intensely Weathered, material is altering to clay, core scratches with light to moderate knife pressure. 118.5-254.8': **POMONA MEMBER (Tp)** of the Saddle Mountains Basalt Formation, Miocene Columbia River Basalt Group (CRBG). Black to gray, hard, mostly fine grained, dense basalt with plagioclase phenocrysts comprising less than 5% of the rock. Descriptions are based on PQ and HQ-size core samples. 118.5-132.0': INVASIVE FLOW TOP (PEPERITE) CONSISTING OF SELAH INTERBED (Ts) of the Ellensburg Formation. Pumicite material rafted to the top of the Pomona Basalt, composed of reddish orange, black to gray, moderately soft tuffaceous clay, silt, sand and gravel. Descriptions are based on HQ-size core samples. 118.5-120.0': SILTY GRAVEL WITH SAND (GM)s (Pumicite). About 50% fine to coarse, hard, angular gravel; about 30% medium to coarse, hard, angular sand; about 20% fines with low plasticity; maximum size, 75 mm; moist, greenish yellow to reddish brown (mottled), abundant iron oxide, clasts composed of moderately weathered, dense to slightly vesicular basalt, chert nodules, cinder and pumice, heterogenous, no reaction with HCl. 120.0-132.0': CLAYEY GRAVEL WITH SAND AND COBBLES (GC)sc (Pumicite). About 50% fine to coarse, hard, angular gravel; about 30% medium to coarse, hard, angular sand; about 20% fines with medium plasticity; maximum size, 75 mm; moist, greenish yellow to reddish

GEOLOGIC LOG OF DRILL HOLE NO. DH-04-1

FEATURE: Black Rock Alternate Damsite
LOCATION: North of Washington State Highway 24
BEGUN: 1/30/04 FINISHED: 3/31/04
DEPTH AND ELEV OF WATER
LEVEL AND DATE MEASURED: 190.9 (1156.45) 3/31/04

PROJECT: Yakima R. Basin Water Storage Feas. Study
COORDINATES: N 439,357.5 E 1,790,476.4
TOTAL DEPTH: 562.3
DEPTH TO BEDROCK: 145.3

STATE: Washington
GROUND ELEVATION: 1347.4
ANGLE FROM HORIZONTAL: AZIMUTH:
HOLE LOGGED BY: Stelma/McAffee/Lyon
REVIEWED BY: R. A. Link

NOTES

155.0-165.0': 95%
165.0-221.4': 100%
221.4-230.1': 95%
230.1-271.4': 100%
271.4-275.1': 70%
275.1-283.1': 90%
283.1-297.7': 85%
297.7-298.4': 80%
298.4-300.3': 75%
300.3-310.3': 90%
310.3-320.4': 85%
320.4-340.4': 70%
340.4-349.4': 75%
349.4-358.2': 70%
358.2-361.5': 75%
361.5-381.5': 80%
381.5-391.5': 85%
391.5-421.5': 90%
421.5-426.6': 80%
426.6-469.6': 90%
469.6-561.6': 95%
561.6-562.3': 0%

WATER LEVEL DURING DRILLING:
(Drill fluid level from ground surface at start of shift)

Date	Fluid Level
01/31	Dry
02/02	8.2'
02/03	10.2'
02/04	0.0'
02/05	+3.9'
02/06	4.6'
02/07	4.7'
02/09	22.4'
02/10	95.4'
02/11	Dry
02/18	Dry
02/19	135.9'
02/20	1.9'
02/21	69.6'
02/23	0.0'
02/24	0.8'
02/25	+2.3'
02/26	1.1'
02/27	20.3'
02/28	136.7'
03/01	121.3'
03/02	122.9'
03/03	192.1'
03/09	192.2'
03/10	115.2'
03/11	94.5'
03/12	40.2'
03/13	7.8'
03/15	21.6'
03/16	20.4'
03/17	Dry

WATER LEVEL AFTER DRILLING:
3/30: 203.3' (el. 1144.1)
3/31: 190.9' (el. 1156.5)
4/02: 192.8' (el. 1154.6)

DRILLING TIME:
Drilling 390 hrs.
Moving: 20 hrs.

(Travel time not included)

HOLE COMPLETION:
0.0-18.0': Bentonite and cement surface seal.
18.0-118.0': Pea gravel.
118.0-183.0': Grout (cement) seal.

DEPTH	% RECOVERY	SPT	ENGINEERING PROPERTIES: WEATHERING	HARDNESS	FRACTURE DENSITY	RQD	FIELD CLASSIFICATION	LAB CLASSIFICATION	GEOLOGIC UNIT	GRAPHIC	HOLE COMPLETION	CLASSIFICATION AND PHYSICAL CONDITION
220	100				FD5	61						brown (mottled), abundant iron oxide, clasts composed of moderately weathered (palagonite on surfaces) dense to slightly vesicular basalt, chert nodules, cinder and pumice, heterogenous, no reaction with HCl.
					FD7	18						
225	100				FD5	78						TOTAL SAMPLE (BY VOLUME): About 30% 3- to 5-inch, hard, angular cobbles; remainder minus 3 inch; maximum dimension, 100 mm.
						20						
230	100				FD6	18						132.0-145.3': ALTERED UPPER FLOW CONTACT. POORLY GRADED GRAVEL (GP). About 100% predominantly fine, hard, subrounded to subangular gravel; dry to moist, gray, clasts composed of slightly weathered (palagonite on surfaces) glassy basalt. Description is based on HQ-size core samples.
235												
	57											
240	100											
	88											
245	27				FD9	9						145.3-150.8': BASALT. Black to gray, fine grained, slightly to moderately vesicular basalt. Most vesicles 1/4 to 1/2", largest 1-1/2" across, coated or filled with soft clay. Slightly Weathered (W3). Oxidation (iron and manganese) limited to fracture surfaces. Hard (H3). Core breaks with heavy hammer blow. Intensely Fractured (FD7). Core recovered in lengths from 0.1 to 0.4', mostly in lengths less than 0.3', joints are mostly horizontal with rough and irregular surfaces. Prior to removal from core barrel (undisturbed) the joints were mostly tight to slightly open.
250	100				FD6	66						
255	100			H5	FD3	100	Claystone					
				H6	FD6	44						Magnetic Polarity on Sample at 150.0': Reverse.
	100											
260	100		W7				Siltstone		Ts			150.8-160.0': BASALT. Black to gray, fine grained, dense basalt. Slightly Weathered (W3). Oxidation (iron and manganese) limited to fracture surfaces. Hard (H3). Core breaks with heavy hammer blow. Intensely Fractured (FD7). Core recovered in lengths from fragments to 0.6', mostly in lengths less than 0.3', joints dip 45 to 60 degrees, surfaces range from smooth and planar to rough and irregular. Prior to removal from core barrel (undisturbed) the joints were mostly tight to slightly open.
265				H4	FD3	70						
270	97											
	100						(GC)s					
275	97			H4	FD7	23						
280	85											160.0-170.0': BASALT. Black to gray, fine grained, dense basalt. Slightly Weathered (W3). Oxidation (iron and manganese) limited to fracture surfaces. Hard (H3). Core breaks with heavy hammer blow. Very Intensely to Intensely Fractured (FD8). Core recovered in lengths from fragments to 0.4', mostly in lengths less than 0.3', a single subvertical joint (with associated horizontal joints) runs the entire length of the interval, the subvertical joint surface ranges from smooth and planar to rough and irregular. Prior to removal from core barrel (undisturbed) the joints were mostly tight to slightly open.
285	98				FD6	33						
290	100											
295	93				FD9	5						170.0-180.0': BASALT. Black to gray, fine grained, dense basalt. Slightly Weathered (W3). Oxidation (iron and manganese) limited to fracture surfaces. Hard (H3). Core breaks with heavy hammer blow. Intensely Fractured (FD7). Core recovered in lengths from fragments to 0.6', mostly in lengths less than 0.3', the joint surfaces range from smooth and planar to rough and irregular. Prior to removal from core barrel (undisturbed) the joints were mostly tight to slightly open.
	100											
300	95											
305	100				FD2	96						
310												
315	99											180.0-183.0': BASALT. Black to gray, fine grained, dense basalt. Slightly Weathered (W3). Oxidation (iron and manganese) limited to fracture surfaces. Hard (H3). Core breaks with heavy hammer blow. Very Intensely Fractured (FD9). Core recovered mostly as fragments, a single subvertical joint (with associated horizontal joints) runs the entire length of the interval, the subvertical joint surface is rough and irregular and coated with iron and manganese oxide. Prior to removal from core barrel (undisturbed) the joints were mostly tight to slightly open.
320												
325	100				FD7	31						
330												
335	100				FD3	99						183.0-201.4': BASALT. Black to gray basalt, mostly fine grained with plagioclase phenocrysts up to 1-3 mm diameter. Phenocrysts comprise less than 5% of the rock. Slightly Weathered (W3). Oxidation (iron and

GEOLOGIC LOG OF DRILL HOLE NO. DH-04-1

FEATURE: Black Rock Alternate Damsite
LOCATION: North of Washington State Highway 24
BEGUN: 1/30/04 FINISHED: 3/31/04
DEPTH AND ELEV OF WATER
LEVEL AND DATE MEASURED: 190.9 (1156.45) 3/31/04

PROJECT: Yakima R. Basin Water Storage Feas. Study
COORDINATES: N 439,357.5 E 1,790,476.4
TOTAL DEPTH: 562.3
DEPTH TO BEDROCK: 145.3

STATE: Washington
GROUND ELEVATION: 1347.4
ANGLE FROM HORIZONTAL: AZIMUTH:
HOLE LOGGED BY: Stelma/McAffee/Lyon
REVIEWED BY: R. A. Link

NOTES	DEPTH	% RECOVERY	SPT	ENGINEERING PROPERTIES: WEATHERING	HARDNESS	FRACTURE DENSITY	RQD	FIELD CLASSIFICATION	LAB CLASSIFICATION	GEOLOGIC UNIT	GRAPHIC	HOLE COMPLETION	CLASSIFICATION AND PHYSICAL CONDITION
183.0-256.0': Bentonite seal. 256.0-266.0': Filter sand. 266.0-286.0': Slotted pipe (.020") with 1" diameter pvc riser and filter sand (#8-12). 286.0-288.0': Filter sand. 288.0-562.3': Bentonite seal. Note: Downhole geophysical testing was performed prior to extraction of core drilling rods.	340			W3	H3			Basalt		Teq/Tum			manganese) limited to fracture surfaces, phenocrysts are soft and discolored to a grayish white color. Hard (H3). Core breaks with heavy hammer blow. Intensely to Moderately Fractured (FD6). Core recovered in lengths from fragments to 0.6', mostly in lengths less than 0.4', the joint surfaces are mostly smooth and planar to irregular. Prominent subvertical joints were observed from 190.0-191.1', 191.7-194.0' and 192.3-195.3'. Prior to removal from core barrel (undisturbed) the joints were mostly tight to slightly open.
	345	100				FD7	20						
	350												
	355	99				FD4	78						
	360	97											
	365	100											201.4-210.7': BASALT. Black to gray basalt, mostly fine grained with plagioclase phenocrysts up to 1-2 mm diameter. Phenocrysts comprise less than 5% of the rock. Slightly Weathered (W3). Oxidation (iron and manganese) limited to fracture surfaces, phenocrysts are soft and discolored to a grayish white color. Hard (H3). Core breaks with heavy hammer blow. Moderately Fractured (FD5). Core recovered in lengths from fragments to 1.7', mostly in lengths less than 0.7', the joint surfaces are mostly smooth and planar to irregular. Numerous joints were weakly rehealed (silica), but separated upon handling, A single subvertical joint was observed from 208.0-209.3'. Prior to removal from core barrel (undisturbed) the joints were tight to slightly open.
	370						100						
	375	100											
	380												Magnetic Polarity on Sample at 201.4': Reverse.
	385	100					95						210.7-216.5': BASALT. Black to gray basalt, mostly fine grained with plagioclase phenocrysts up to 1-2 mm diameter. Phenocrysts comprise less than 5% of the rock. Slightly Weathered (W3). Oxidation (iron and manganese) limited to fracture surfaces, phenocrysts are soft and discolored to a grayish white color. Hard (H3). Core breaks with heavy hammer blow. Intensely Fractured (FD7). Core recovered in lengths from fragments to 0.4', mostly in lengths less than 0.3', the joint surfaces are mostly smooth and planar to irregular. Numerous joints were weakly rehealed (silica), but separated upon handling, A single subvertical joint was observed extending through the entire interval. Prior to removal from core barrel (undisturbed) the joints were tight to slightly open.
	390	100				FD3	98						
	395	100					92						
	400												
	405	100											216.5-222.2': BASALT. Black to gray basalt, mostly fine grained with plagioclase phenocrysts up to 1-2 mm diameter. Phenocrysts comprise less than 5% of the rock. Slightly Weathered (W3). Oxidation (iron and manganese) limited to fracture surfaces, phenocrysts are soft and discolored to a grayish white color. Hard (H3). Core breaks with heavy hammer blow. Moderately Fractured (FD5). Core recovered in lengths from 0.2 to 0.9', mostly in lengths of 0.7', the joint surfaces are mostly smooth and planar to irregular. Numerous joints were weakly rehealed (silica), but separated upon handling. Prior to removal from core barrel (undisturbed) the joints were tight to slightly open.
	410						100						
	415	100											
	420												
	425	92			H5		77						
	430	100		W4									222.2-224.4': BASALT. Black to gray basalt, mostly fine grained with plagioclase phenocrysts up to 1-2 mm diameter. Phenocrysts comprise less than 5% of the rock. Slightly Weathered (W3). Oxidation (iron and manganese) limited to fracture surfaces, phenocrysts are soft and discolored to a grayish white color. Hard (H3). Core breaks with heavy hammer blow. Intensely Fractured (FD7). Core recovered in lengths from fragments to 0.3', joint surfaces are mostly smooth and planar to irregular and coated with brownish-red clay. Prior to removal from core barrel (undisturbed) the joints were tight to slightly open.
	435	100											
	440						90						
	445					FD4							
	450	100		W2	H3								224.4-228.1': BASALT. Black to gray basalt, mostly fine grained with plagioclase phenocrysts up to 1-2 mm diameter. Phenocrysts comprise less than 5% of the rock. Slightly Weathered (W3). Oxidation (iron and manganese) limited to fracture surfaces, phenocrysts are soft and discolored to a grayish white color. Hard (H3).. Core breaks with heavy hammer blow. Moderately Fractured (FD5). Core recovered in lengths from 0.4 to
	455	100					98						

GEOLOGIC LOG OF DRILL HOLE NO. DH-04-1

FEATURE: Black Rock Alternate Damsite
LOCATION: North of Washington State Highway 24
BEGUN: 1/30/04 FINISHED: 3/31/04
DEPTH AND ELEV OF WATER
LEVEL AND DATE MEASURED: 190.9 (1156.45) 3/31/04

PROJECT: Yakima R. Basin Water Storage Feas. Study
COORDINATES: N 439,357.5 E 1,790,476.4
TOTAL DEPTH: 562.3
DEPTH TO BEDROCK: 145.3

STATE: Washington
GROUND ELEVATION: 1347.4
ANGLE FROM HORIZONTAL: AZIMUTH:
HOLE LOGGED BY: Stelma/McAffee/Lyon
REVIEWED BY: R. A. Link

NOTES	DEPTH	% RECOVERY	SPT	ENGINEERING PROPERTIES: WEATHERING	HARDNESS	FRACTURE DENSITY	RQD	FIELD CLASSIFICATION	LAB CLASSIFICATION	GEOLOGIC UNIT	GRAPHIC	HOLE COMPLETION	CLASSIFICATION AND PHYSICAL CONDITION
	460	100					100						1.1', mostly in lengths of 0.8', the joint surfaces are mostly smooth and planar to irregular. Numerous joints were weakly rehealed (silica), but separated upon handling. Prior to removal from core barrel (undisturbed) the joints were tight to slightly open.
	465	97					35						
	470	100		W7	H5	FD3	79	Siltstone		Tm			228.1-242.3': BASALT. Black to gray basalt, mostly fine grained with plagioclase phenocrysts up to 1-2 mm diameter. Phenocrysts comprise less than 5% of the rock. Slightly Weathered (W3). Oxidation (iron and manganese) limited to fracture surfaces, phenocrysts are soft and discolored to a grayish white color. Hard (H3). Core breaks with heavy hammer blow. Intensely to Moderately Fractured (FD6). Core recovered in lengths from fragments to 0.6', joint surfaces are mostly smooth and planar to irregular. Numerous joints were weakly rehealed (silica), but separated upon handling, Prominent subvertical joints were observed from 228.1-232.2' and 232.3-236.9'. Prior to removal from core barrel (undisturbed) the joints were tight to slightly open.
	475	100											
	480												
	485	100											
	490	89		W9	H6	FD9	0	SP					242.3-251.4': BASALT (Poor Recovery). Black to gray basalt, mostly fine grained with plagioclase phenocrysts up to 1-2 mm diameter. Phenocrysts comprise less than 5% of the rock. Slightly Weathered (W3). Oxidation (iron and manganese) limited to fracture surfaces, phenocrysts are soft and discolored to a grayish white color. Hard (H3). Core breaks with heavy hammer blow. Very Intensely Fractured (FD9). Core recovered in lengths from fragments to 0.4', mostly fragments, the joint surfaces are mostly smooth and planar to irregular.
	495												
	500	82											
	505			W7	H5	FD3	100	Siltstone					251.4-254.8': BASALT. Black to gray basalt, mostly fine-grained with plagioclase phenocrysts up to 1-2 mm diameter. Phenocrysts comprise less than 5% of the rock. Fairly sharp contact with underlying claystone. Slightly Weathered (W3). Oxidation (iron and manganese) limited to fracture surfaces, phenocrysts are soft and discolored to a grayish white color. Hard (H3). Core breaks with heavy hammer blow. Intensely to Moderately Fractured (FD6). Core recovered in lengths from fragments to 0.9', mostly less than 0.4', the joint surfaces are mostly smooth and planar to irregular. Numerous joints were weakly rehealed (silica), but separated upon handling. Prior to removal from core barrel (undisturbed) the joints were tight to slightly open.
	510	99											
	515							Sandstone					
	520												
	525	100											
	530							Siltstone					254.8-277.1': **SELAH INTERBED (Ts)** of the Miocene Ellensburg Formation. Reddish orange, black to gray, moderately soft tuffaceous siltstone and claystone. Descriptions are based on HQ-size core samples.
	535	100											
	540							Claystone					255.8-258.2': TUFFACEOUS CLAYSTONE. Fine to medium grained, reddish orange to greenish yellow, heterogenous, well indurated clay-size to medium sand-sized lithic fragments, pumice, ash and chert. Intensely Weathered (W7). Material has been thermally altered and oxidized. Moderately Soft (H5). Core scratches with light to moderate knife pressure. Slightly Fractured (FD3). Core recovered mostly in lengths from 1.0 to 3.0'.
	545	100				FD5	58	Siltstone					
	550					FD6							
	555	100					48	Claystone					258.2-263.0': TUFFACEOUS SILTSTONE AND SANDSTONE . Fine to medium grained, black, heterogenous, well indurated silt-size to medium sand-sized lithic fragments, pumice, ash and chert. Intensely Weathered (W7). Material has been thermally altered and oxided. Soft (H6). Core breaks with light manual pressure. Intensely to Moderately Fractured (FD6). Core recovered in lengths from fragments to 0.8", and mostly in lengths less than 0.4'.
		90											
	560	100		W3	H4		47	Basalt		Tpr			
								BOTTOM OF HOLE					263.0-273.6': TUFFACEOUS SILTSTONE AND SANDSTONE. Fine to medium grained, white to light brown and gray (mottled), heterogenous, well indurated silt-size to coarse sand-sized (5 mm) lithic fragments, pumice, ash and chert. Intensely Weathered (W7). Abundant calcium carbonate nodules and stringers

GEOLOGIC LOG OF DRILL HOLE NO. DH-04-1

FEATURE: Black Rock Alternate Damsite
LOCATION: North of Washington State Highway 24
BEGUN: 1/30/04 FINISHED: 3/31/04
DEPTH AND ELEV OF WATER
LEVEL AND DATE MEASURED: 190.9 (1156.45) 3/31/04

PROJECT: Yakima R. Basin Water Storage Feas. Study
COORDINATES: N 439,357.5 E 1,790,476.4
TOTAL DEPTH: 562.3
DEPTH TO BEDROCK: 145.3

STATE: Washington
GROUND ELEVATION: 1347.4
ANGLE FROM HORIZONTAL: AZIMUTH:
HOLE LOGGED BY: Stelma/McAffee/Lyon
REVIEWED BY: R. A. Link

NOTES	DEPTH	% RECOVERY	SPT	ENGINEERING PROPERTIES: WEATHERING	HARDNESS	FRACTURE DENSITY	RQD	FIELD CLASSIFICATION	LAB CLASSIFICATION	GEOLOGIC UNIT	GRAPHIC	HOLE COMPLETION	CLASSIFICATION AND PHYSICAL CONDITION

present due to extensive leaching and solutioning of rock (strong reaction with HCl). Moderately Hard (H4). Core breaks with heavy manual pressure. Slightly Fractured (FD3). Core recovered mostly in lengths from 1.0 to 2.0'. Possible brecciated zone. Slickensides (striations) noted on joint surfaces at 271.6', 271.9', 272.5', 272.7' 272.8' and 273.0'.

273.6-277.1': TUFFACEOUS CLAYEY GRAVEL WITH SAND (GC)s. About 70% fine, moderately soft, angular sand; about 20% fines with medium plasticity; about 10% fine, moderately soft, angular gravel; moist, brown to dark brown, clasts composed of chert and claystone. Slickensides (striations) noted on joint surface at 273.8'.

279.4-467.0': **ESQUATZEL/UMATILLA UNDIFFERENTIATED MEMBERS (Teq/Tum)** of the Saddle Mountains Basalt Formation, Miocene Columbia River Basalt Group (CRBG. Black to gray, hard, mostly fine grained dense basalt. Descriptions are based on HQ-size core samples.

276.0-277.1': BASALT. Black to gray, mostly fine grained, dense basalt. Fairly sharp contact with overlying sediment. Moderately Weathered (W3). Extensive oxidation (iron and manganese) and clay deposits on fracture surfaces, body of rock is weakened by weathering. Moderately Hard (H4). Core breaks with moderate hammer blow. Intensely Fractured (FD7). Core recovered in lengths from fragments to 1.0', mostly less than 0.3', the joint surfaces are mostly smooth and planar to irregular.

277.1-295.9': BASALT. Black to gray, mostly fine grained, dense basalt. Slightly vesicular from 287.5-289.7. Slightly Weathered (W3). Oxidation (iron and manganese) and coatings limited to fracture surfaces. Hard (H3). Core breaks with heavy hammer blow. Intensely to Moderately Fractured (FD6). Core recovered in lengths from fragments to 0.9, and mostly in lengths greater than 0.5', the joint surfaces are mostly smooth and planar to irregular. Prominent vertical joint and associated fracture zone from 290.2-293.0'. Numerous joints were weakly rehealed (silica), but separated upon handling. Prior to removal from core barrel (undisturbed) the joints were tight to slightly open. Slickensides (poorly defined striations) noted on subvertical joint surface from 287.5-289.7', surface is extensively oxidized with abundant clayey material.

Magnetic Polarity on Sample at 285.5': Normal.

295.9-303.2': BASALT. Black to gray, mostly fine grained, dense basalt. Slightly Weathered (W3). Extensive oxidation (iron and manganese) and greenish yellow clay coatings on fracture surfaces. Hard (H3). Core breaks with heavy hammer blow. Very Intensely Fractured (FD9). Core recovered mostly as fragments, fracture surfaces are mostly smooth and planar to irregula . Prior to removal from core barrel (undisturbed) the joints were tight to slightly open.

303.2-322.6': BASALT. Black to gray, mostly fine grained, dense basalt. Fresh to Slightly Weathered (W2). Minor oxidation (iron and manganese) limited to fracture surfaces. Hard (H3). Core breaks with heavy hammer blow. Slightly to Very Slightly Fractured (FD2). Core recovered in lengths ranging from 0.4' to 4.0', mostly in lengths greater than 3.0', fracture surfaces are mostly smooth and irregular to smooth and planar. Prior to removal from core barrel (undisturbed) the joints were mostly tight.

322.6-326.7': BASALT. Black to gray, mostly fine grained, dense basalt. Slightly Weathered (W3). Oxidation (iron and manganese) limited to fracture surfaces. Hard (H3). Core breaks with heavy hammer blow. Intensely Fractured (FD7). Core recovered in lengths from fragments to 1.7', mostly in lengths less

GEOLOGIC LOG OF DRILL HOLE NO. DH-04-1

FEATURE: Black Rock Alternate Damsite
LOCATION: North of Washington State Highway 24
BEGUN: 1/30/04 FINISHED: 3/31/04
DEPTH AND ELEV OF WATER
LEVEL AND DATE MEASURED: 190.9 (1156.45) 3/31/04

PROJECT: Yakima R. Basin Water Storage Feas. Study
COORDINATES: N 439,357.5 E 1,790,476.4
TOTAL DEPTH: 562.3
DEPTH TO BEDROCK: 145.3

STATE: Washington
GROUND ELEVATION: 1347.4
ANGLE FROM HORIZONTAL: AZIMUTH:
HOLE LOGGED BY: Stelma/McAffee/Lyon
REVIEWED BY: R. A. Link

NOTES	DEPTH	% RECOVERY	SPT	ENGINEERING PROPERTIES: WEATHERING	HARDNESS	FRACTURE DENSITY	RQD	FIELD CLASSIFICATION	LAB CLASSIFICATION	GEOLOGIC UNIT	GRAPHIC	HOLE COMPLETION	CLASSIFICATION AND PHYSICAL CONDITION

than 0.3', the joint surfaces are mostly smooth and planar to irregular to rough and irregular. A single subvertical joint and associated horizontal joints were observed through the entire interval. Prior to removal from core barrel (undisturbed) the joints were generally tight to slightly open.

326.7-341.1': BASALT. Black to gray, mostly fine grained, dense basalt. Fresh to Slightly Weathered (W2). Minor oxidation (iron and manganese) limited to fracture surfaces. Hard (H3). Core breaks with heavy hammer blow. Slightly Fractured (FD3). Core recovered in lengths ranging from 0.5' to 2.4', mostly in lengths between 1.0 and 1.5', fracture surfaces are mostly smooth and planar to smooth and irregular. Prior to removal from core barrel (undisturbed) the joints were mostly tight.

341.1-349.9': BASALT. Black to gray, mostly fine grained, dense basalt. Slightly Weathered (W3). Oxidation (iron and manganese) limited to fracture surfaces. Hard (H3). Core breaks with heavy hammer blow. Intensely Fractured (FD7). Core recovered in lengths from fragments to 1.7', mostly in lengths less than 0.3', the joint surfaces are mostly smooth and planar to irregular to rough and irregular. A single subvertical joint and associated horizontal joints were observed through the entire interval. Prior to removal from core barrel (undisturbed) the joints were generally tight to slightly open.

349.9-358.2': BASALT. Black to dark green, mostly fine grained, dense basalt. Slightly Weathered (W3). Oxidation (iron and manganese) generally limited to fracture surfaces. Hard (H3). Core breaks with heavy hammer blow. Moderately to Slightly Fractured (FD4). Core recovered in lengths from fragments to 1.6', mostly in lengths around 0.8', the joint surfaces are mostly smooth and planar to irregular to rough and irregular. A single subvertical joint and associated horizontal joints were observed through most of the interval. Prior to removal from core barrel (undisturbed) the joints were generally tight to slightly open.

358.2-421.5': BASALT. Black to gray, mostly fine grained, dense basalt. Slightly Weathered (W3). Oxidation (iron and manganese) generally limited to fracture surfaces. Hard (H3). Core breaks with heavy hammer blow. Slightly Fractured (FD3). Core recovered in lengths from 0.1' to 2.8', mostly in lengths about 1.4', the joint surfaces are mostly smooth and planar to irregular to rough and irregular. Prior to removal from core barrel (undisturbed) the joints were generally tight to slightly open.

Magnetic Polarity on Sample at 360.3': Normal.

Magnetic Polarity on Sample at 384.7': Normal.

421.5-426.6': BASALT. Black to gray, fine grained, slightly to moderately vesicular basalt. Slightly Weathered (W3). Oxidation (iron and manganese) generally limited to fracture surfaces. Hard (H5). Core breaks with moderate to heavy hammer blow. Moderately to Slightly Fractured (FD4). Core recovered in lengths from fragments to 0.9', mostly in lengths around 0.4', the joint surfaces are mostly smooth and planar to irregular to rough and irregular.

426.6-431.5': BASALT (FLOW BRECCIA). Dark green to black, fine grained, moderately to strongly vesicular basalt. Moderately to Slightly Weathered (W4). Numerous indurated clay and silty clay seams, body of rock is slightly weathered. Hard (H5). Core breaks with moderate to heavy hammer blow. Moderately to Slightly Fractured (FD4). Core recovered in lengths from 0.2' to 1.9', mostly in lengths about 0.4', the joint surfaces are mostly rough and irregular.

GEOLOGIC LOG OF DRILL HOLE NO. DH-04-1

FEATURE: Black Rock Alternate Damsite
LOCATION: North of Washington State Highway 24
BEGUN: 1/30/04 FINISHED: 3/31/04
DEPTH AND ELEV OF WATER
LEVEL AND DATE MEASURED: 190.9 (1156.45) 3/31/04

PROJECT: Yakima R. Basin Water Storage Feas. Study
COORDINATES: N 439,357.5 E 1,790,476.4
TOTAL DEPTH: 562.3
DEPTH TO BEDROCK: 145.3

STATE: Washington
GROUND ELEVATION: 1347.4
ANGLE FROM HORIZONTAL: AZIMUTH:
HOLE LOGGED BY: Stelma/McAffee/Lyon
REVIEWED BY: R. A. Link

NOTES	DEPTH	% RECOVERY	SPT	ENGINEERING PROPERTIES: WEATHERING	HARDNESS	FRACTURE DENSITY	RQD	FIELD CLASSIFICATION	LAB CLASSIFICATION	GEOLOGIC UNIT	GRAPHIC	HOLE COMPLETION	CLASSIFICATION AND PHYSICAL CONDITION

431.5-461.5': BASALT. Black to gray, mostly fine grained, dense to very slightly vesicular basalt. Slightly Weathered (W2). Oxidation (iron and manganese) generally limited to fracture surfaces, some vesicles infilled with calcium carbonate (strong reaction with HCl). Hard (H3). Core breaks with heavy hammer blow. Moderately to Slightly Fractured (FD4). Core recovered in lengths from fragments to 0.1' to 2.8', mostly in lengths about 1.4', the joint surfaces are mostly smooth and planar, with scattered irregular to rough and irregular surfaces.

Magnetic Polarity on Sample at 455.5': Normal.

457.0-459.2': LEAN CLAY. (Inclusion of underlying Mabton Interbed). About 100% fines with medium plasticity, slow dilatancey and medium toughness, green, moist.

467.0-555.8': **MABTON INTERBED (Tm)** of the Miocene Ellensburg Formation. Light green to to dark brown, moderately soft, tuffaceous siltstone, sandstone and claystone. Descriptions are based on HQ-size core samples.

467.0-490.0': SILTSTONE. Fine grained, light green to gray, homogeneous, well indurated silt-size to some medium sand-sized fragments with abundant mafic and micaceous material. Intensely Weathered (W7). Material is partially altered to clay. Moderately Soft (H5). Core scratches with light to moderate knife pressure. Slightly Fractured (FD3). Core recovered mostly in lengths from 1.0 to 3.0'.

490.0-502.4': POORLY GRADED SAND (SP). About 100% predominantly medium, hard, subangular to angular sand; dry to moist, gray with reddish brown lenses, abundant iron oxide.

502.4-510.9': SILTSTONE. Fine grained, light green to tan, homogeneous, well indurated silt-size material. Intensely Weathered (W7). Some minerals altered to clay due to extensive leaching and solutioning of rock. Moderately Soft (H5). Core scratches with light to moderate knife pressure. Slightly Fractured (FD3). Core recovered mostly in lengths ranging from 1.0 to 3.0'.

510.9-525.8': SANDSTONE. Fine to medium grained, green to black, homogeneous, well indurated silt-size to medium sand-sized fragments with abundant mafic and micaceous material. Intensely Weathered (W7). Some of the minerals are altered to clay due to extensive leaching and solutioning of rock. Moderately Soft (H5). Core scratches with light to moderate knife pressure. Slightly Fractured (FD3). Core recovered in lengths from 1.0 to 3.0'.

525.8-536.1': SILTSTONE. Fine grained, light green to white, homogeneous, well indurated silt-size material. Intensely Weathered (W7). Some minerals altered to clay due to extensive leaching and solutioning of rock. Moderately Soft (H5). Core scratches with light to moderate knife pressure. Slightly Fractured (FD3). Core recovered mostly in lengths ranging from 0.5 to 5.0'.

536.1-543.9': CLAYSTONE. Fine grained, greenish gray to black, homogeneous, well indurated clay-size material. Intensely Weathered (W7). Sample is mostly clay due to extensive leaching and solutioning of rock. Moderately Soft (H5). Core scratches with light to moderate knife pressure. Slightly Fractured (FD3). Core recovered mostly in lengths ranging from 0.9 to 1.8'.

543.9-549.4': SILTSTONE. Fine grained, mottled dark brown to black, well indurated silt-size material. Abundant organics, wood and coal (lignite) fragments up to 25 mm. Intensely Weathered (W7). Some minerals altered to clay due to due to extensive leaching and solutioning of rock. Moderately Soft (H5). Core

GEOLOGIC LOG OF DRILL HOLE NO. DH-04-1

FEATURE: Black Rock Alternate Damsite
LOCATION: North of Washington State Highway 24
BEGUN: 1/30/04 FINISHED: 3/31/04
DEPTH AND ELEV OF WATER
LEVEL AND DATE MEASURED: 190.9 (1156.45) 3/31/04

PROJECT: Yakima R. Basin Water Storage Feas. Study
COORDINATES: N 439,357.5 E 1,790,476.4
TOTAL DEPTH: 562.3
DEPTH TO BEDROCK: 145.3

STATE: Washington
GROUND ELEVATION: 1347.4
ANGLE FROM HORIZONTAL: AZIMUTH:
HOLE LOGGED BY: Stelma/McAffee/Lyon
REVIEWED BY: R. A. Link

NOTES	DEPTH	% RECOVERY	SPT	ENGINEERING PROPERTIES: WEATHERING	HARDNESS	FRACTURE DENSITY	RQD	FIELD CLASSIFICATION	LAB CLASSIFICATION	GEOLOGIC UNIT	GRAPHIC	HOLE COMPLETION	CLASSIFICATION AND PHYSICAL CONDITION

scratches with light to moderate knife pressure. Moderately Fractured (FD5). Core recovered mostly in lengths ranging from 0.4 to 1.0'. Slickensides (striations) noted on subvertical joint surfaces at 543.9', 546.4', 546.6' and at 549.4'.

549.4-555.8': CLAYSTONE. Fine grained, mottled greenish brown, well indurated clay-size material. Trace of organics, wood fragments up to 10 mm. Intensely Weathered (W7). Sample is mostly clay due to extensive leaching and solutioning of rock. Moderately Soft (H5). Core scratches with light to moderate knife pressure. Slightly Fractured (FD3). Core recovered mostly in lengths ranging from 0.9 to 1.8'. Slickensides (striations) noted on joint surfaces at 550.5', 553.2', 553.3', 554.2' and at 555.8'.

555.8-562.3': **PRIEST RAPIDS MEMBER (Tpr)** of the Wanapum Basalt Formation, Miocene Columbia River Basalt Group (CRB). Black to gray, hard, fine grained to porphyritic, vesicular basalt. Descriptions are based on HQ-size core samples.

556.0-562.3': BASALT. Black to gray moderately vesicular basalt, mostly fine grained with abundant elongate and angular plagioclase phenocrysts up to 1 mm diameter. Phenocrysts comprise about 10% of the rock. Fairly sharp contact with overlying claystone. Slightly Weathered (W3). Oxidation (iron and manganese) limited to fracture surfaces; vesicles are infilled with bluish silt and clay; abundant iron pyrite noted on fracture surface and within vesicles; all phenocrysts are discolored to a grayish white color. Hard (H3). Core breaks with moderate hammer blow. Intensely to Moderately Fractured (FD6). Core recovered in lengths from fragments to 0.9', mostly less than 0.4', the joint surfaces are mostly rough and planar to rough and irregular. Prior to removal from core barrel (undisturbed) the joints were moderately open (1 to 3 mm).

Magnetic Polarity on Sample from 560.0-560.7': Reverse.

562.3': BOTTOM OF HOLE


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 0º to 43º


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 43º to 60º

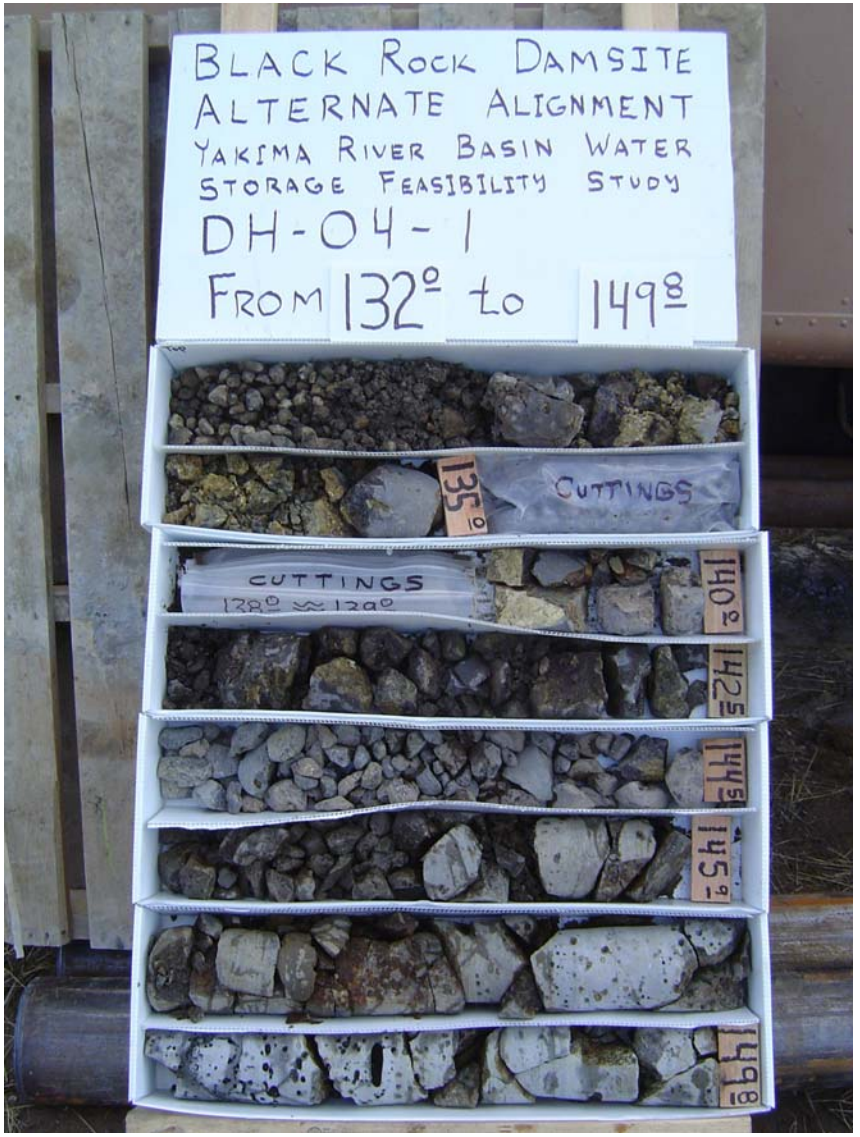

BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 60º to 75º
60°
65°
68'
70°
72'
75°


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 75º to 85º
78'
80°
81'
85°


ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 85° to 100°
90°
95°
100


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 100° to 115°
100°
105°
110
115°


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 115' to 132'
119.5
120'
125'
129
130
132


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 132' to 149.8'
135'
CUTTINGS
CUTTINGS
138' ≈ 139'
140'
142.5'
144.5'
145.5'
149.8'


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 149' TO 166'

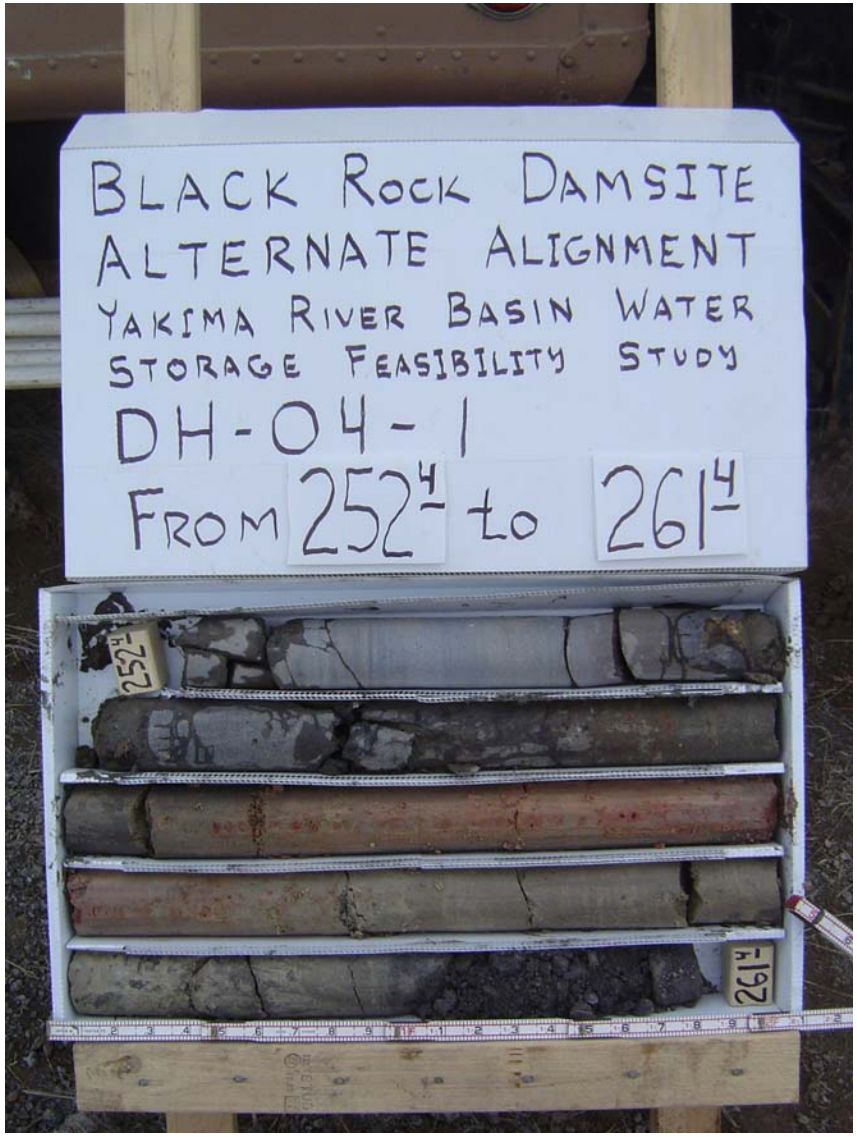

BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 166' TO 183'


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 183' TO 199 3/4'
183'
191 1/4
199 3/4


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 199 3/4 TO 215 8/12
201 1/4
208 8/12
211 1/4


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 215 8 TO 232 2
215 8
216 5
221 4
230'
232 2


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 232 2 TO 252 4
232 2
238 2
238 9
240 3
241 4
242 3
251 4
252 4


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 252 4/5 to 261 4/5
252 4/5
261 4/5


BLACK ROCK DAMSITE
ALTERNATE ALIGNMENT
YAKIMA RIVER BASIN WATER
STORAGE FEASIBILITY STUDY
DH-04-1
FROM 261 4/5 to 279 8/5
261 4/5
264 6/5
267 9/5
271 1/5
275 1/5